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ABSTRACT

The adoption and use of new interactive technologies in Distance Education, especially Tele-learning is a growing tendency in the most advanced countries. Nowadays, this tendency is so strong that being interactive is seen as a necessary pre-condition. Some reasons for this are a the growing perceived value of group-working; the popularization of the constructivist model, where the process and context in which the learning happens has a significative value; the lowering prices of telecommunication equipment and transmission costs, that facilitates its application to a wide variety of purpose and objectives. Tele-learning may be seen as an answer to the demand for open and flexible learning, using different technologies, in different context, among different levels and learning styles. It also attends to the pedagogical and curricular questions of different institutions, educational or not, as well as to different philosophical and strategic goals. The intent of this article is to discuss problems, benefits and other questions that the adoption of Tele-learning poses to Brazilian reality. The article analyses current research in Technology Based Distance Education and compares it to the results of a research conducted with 87 students and 6 teachers of two Engineering Masters' Degrees offered by the PPGEP (The Graduate Program in Production Engineering of The Federal University of Santa Catarina, UFSC) for private organizations. In these Masters Programs, PPGEP has been using state-of-the-art Video Conferencing (two-way video) equipment for lectures and a selection of Internet based tools to provide students and teachers with an interactive environment outside classroom activities. The first results indicate that Tele-learning allows not only an improvement of the teaching-learning process but also a pedagogical re-engineering, through the combination of different pedagogical techniques with the available technological resources, as never seen before. (Contains 11 references.) (Author/YDS)

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Tele-learning and Distance Learning re-engineering process

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Abstract: *The adoption and use of new interactive technologies in Distance Education, especially Tele-learning, is a growing tendency in the most advanced countries. Nowadays, this tendency is so strong that being interactive is seen as a necessary pre-condition. Some reasons for this are the growing perceived value of group-working; the popularisation of the constructivist model, where the process and context in which the learning happens has a significative value; the lowering prices of telecommunication equipment and transmission costs, that facilitates its application to a wide variety of purpose and objectives. Tele-learning may be seen as an answer to the demand for open and flexible learning, using different technologies, in different contexts, among different levels and learning styles. It also attends to the pedagogical and curricular questions of different institutions, educational or not, as well as to different philosophical and strategic goals. The intent of this article is to discuss problems, benefits, and other questions that the adoption of Tele-learning poses to Brazilian reality. The article analyses current research in Technology Based Distance Education and compares it to the results of a research conducted with 87 students and 6 teachers of two Engineering Masters' Degrees offered by the PPGEP (The Graduate Program in Production Engineering of The Federal University of Santa Catarina, UFSC) for private organisations. In these Masters Programs, PPGEP has been using state-of-the-art Video Conferencing (two-way video) equipment for lectures and a selection of Internet based tools to provide students and teachers with an interactive environment outside of classroom activities. The first results indicate that Tele-learning allows not only an improvement of the teaching-learning process but also a pedagogical re-engineering, through the combination of different pedagogical techniques with the available technological resources, as never seen before.*

Introduction

We are living in a globalized world where information and knowledge are seen as a powerful commodity. The world where we live, and where globalization seems to be the word/concept of the moment, is marked not only by the growing importance of information, but above all, knowledge distribution and production. To have access to information and possibility to use it to produce and also distribute knowledge is fundamental to be part of the market (the productive process). For these reasons there is a growing demand for Continuing Education, Flexible learning, and all forms of professional training offered by using Third Generation or Technology Based Distance Education techniques.

Using the wide selection of interactive media to which we have access today, it is possible to improve the potential of continuing education, and of other models of Distance Education. The use of telecommunications technology makes it possible for universities and schools to open up to the world, overcoming its boundaries (Tiffin, 1995). Students and teachers can exchange information, work collaboratively in research and class projects, and/or just communicate with colleagues, making academic life more motivating and productive.

Tele-learning is possible because of the latest technological innovations. However, it is not only a result of a technological revolution, it also implies the adoption of a new educational paradigm, where the student is empowered, and teachers are seen as advisors, showing some of the paths they can follow. There is no longer only one answer, but the construction of a collaborative understanding. To work in this new context, teachers need to re-think their practice, as well as students. The emerging new paradigm considers learning as a social process, and using live – interactive

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technologies appears to be very important to the success of all education programs.

Despite its standing benefits, Tele-learning is not widespread in Brazil. One of the barriers to its adoption is the price of the necessary technology (still high), in contrast with government investments in education and science (still low). In the past two decades, the economic resources applied to Science and Technology have been around 0,5 to 0,6% of the national GNP. Most developed countries invested around 2.5% in the same period. Today Brazil is 8th in the world economy, but is the 30th country in S & T. There are more than 1500 undergraduate courses in Brazil, with around 1.150.000 students regularly enrolled. Of these, only 150.000 are following Engineering courses. Two third (2/3) of the students in undergraduate level are in the Humanities. Most of them will be unemployed when leaving university. All of the Engineering students will need some kind of specialized training after completing their courses. At least 50% of them are potential users of DE courses in Engineering, because they will need to keep constantly updated in order to keep their jobs in industry, or to get a state grant to follow a Graduate program, or to do independent research.

This picture reflects Brazil's politic and economic situation, which is not our focus in this article. However, it is meaningful in order to understand how important are the initiatives in distance education using Tele-learning for the development of a better quality S&T production in Brazil. In the case of Brazilian Universities, distance teaching allows for the planning and improvement of the quality of courses in the whole country, and for the integration of these with the productive sector. In this sense, distance teaching can be considered an alternative to better distribute know-how located in the best knowledge centers throughout Brazil, as well as to improve its production.

Since 1995, the Distance Education Laboratory – LED, of the Graduate Program in Production Engineering – PPGEP, has been concentrating efforts in order to offer high quality distance education courses. Some of the programs developed in this period, and currently under development, are specially designed to attend to professional in the field of Engineering, and that are working in different sectors of the economy. In this paper we present some results of research being conducted with teachers, students, and technical personnel of two master's programs offered by PPGEP to two companies: Equitel/Siemens, a leader in telecommunications products, and Petrobras, the state-owned Brazilian oil company.

The new generation of distance education

Most theorists of distance education agree on a basic definition of the field that includes four basic characteristics: "a) teacher and learner must be separated for most of the learning process; b) the course or program must be influenced or controlled by an organized educational institution; c) some form of media must be used, both to overcome the physical separation of teacher and learner and to carry course content; d) two-way communication in some form must be provided between teacher and learner". (Mood, 1995, p. 19)

However, rapid changes in society and technology are challenging these traditional definitions. Several authors discuss that the improvement in technology has also resulted in another redefinition of distance education. Edwards (apud Schlosser, 1997, p.3) states that open learning shifts from mass production and mass consumption to a focus on local and individual needs and requirements. This can occur outside of the traditional organization of education. "Distance education provides distance learning opportunities using mass produced courseware to a mass market. In contrast, open learning places 'greater emphasis on the current specific needs and/or markets available' by recognizing local requirements and differences instead of delivering a preestablished curriculum". (Apud Schlosser, 1997, p.3)

Virtual electronic classrooms are making it possible for the first time to teach face-to-face at a distance. That is why open and flexible learning is considered more descriptive of the new activities using telecommunications, which are changing also the traditional educational environment. The "distance" is not the most important parameter but the way the communication is being done. In this sense, the new generation of distance education can be named as "tele-learning" because its ability to "mak[e] connections among persons and resources through communication technologies for learning related purposes" (Collis, 1995, p. 9).

Tele-learning can be named as educational television, broadcasting, documentaries; computer based communication, computers with a network connection, probably with Internet e-mail access; World Wide Web; interactive television, compressed interactive video, video conferencing. Tele-learning "can take place in different ways, in different settings, with or without a teacher being involved, within different sorts of instructional organization, including within a course or without a course being involved at all, among different levels and types of learners, via a variety of technologies, and through a variety of pedagogias and learning approaches, and for a variety of philosophical and strategic motivations. (Collis, 1995, p. 11) This large definition can be used as the framework when we use here the most common term "Distance Education".

One of the main characteristics of tele-learning is interactivity. Used in an indiscriminate way, most of time used as a synonymous of feedback, nowadays being interactive is seen as a necessary pre-condition. As a human need, it increases motivation and interest. In training situations, increases the speed of assimilation and length and degree of retention of information opportunities for the learner to express himself. It is related to deep level learning and the development of critical thinking. (Mason, 1994, p. 26)

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One of the most promissory mediums to use in interactive courses is videoconferencing. Defined as a "people watching a monitor and talking with the people they are watching" (Collis, 1995), videoconferencing is a telecommunications facility that enables two or more sites, which are separated by geographical distance, to interact with both sound and vision. (Abbot, 1995). As a good medium to create social presence, especially in small groups, videoconferencing can be used for collaborative work. The increasing amount of teamwork in business and industry increased the demand to develop collaborative learning practices in courses. In this sense, interactivity technologies support this at a distance and increase interest in developing collaborative projects, discussions and presentations in adult education and training. (Mason, 1994, p. 31)

Also, the pace of diffusion of the so-called Computer-Mediated Communication (CMC - general purpose term that applies to a variety of communication and information technologies, inclusive Internet.) and the related electronic communication media, is presenting a significant challenge to education (Paulsen, 1995). Among the new media being introduced in distance education, the Internet appears as a widely adopted and quite successful one. This diffusion of Internet, especially of its use as a main or secondary medium for DE courses, leads to a growing necessity to get a better understanding of its implications for the student-teacher, student-student interaction. "The active environment of social learning provided by a computer with access to local, national, and international networks increases interaction and communication among students, their teachers, peers, parents, and other members of the world community." (Berge and Collins, 1995)

Networked computers are used in most Universities, even those offering DE course, to exchange emails, access to WWW sites, and to implement discussion lists or newsgroups. However, there is a growing adoption of the so-called "Virtual University" model, where resources already found in the Internet are adapted to teaching-learning, creating a metaphor of the real school.

If we see tele-learning as a pedagogical phenomenon, we can think how to improve the instructional components that can combine to produce a lesson or course:

1. teacher presentation of concepts and information
2. communication between teacher and student or between student and student about the learning content
3. communication in the form of a discussion among more than two persons about the learning materials
4. self-study, primarily involving reading
5. individual practice and consolidation activities, such as exercises or essays, with some form of feedback
6. group activities
7. assessment and testing activities.

(Collis, 1995, p. 14-15)

Doing the same things, but better: pedagogical enrichment via tele-learning. "Tele-learning can be used to do more than enrich existing pedagogical practice; it can be used to change the balance among components within that practice, or to bring new combinations of components that did not emerge before or perhaps were not even possible before." (Collis, 1995, p. 17) The central question is: how are the different ways in which instructional activities can be adapted in both their balance and combination through tele-learning to do a pedagogical re-engineering?

Before continuing, it is important to make clear that the research results described in this article are the first results of an effort to follow the development of the interactive courses of PPGEP. It is based on the observation of the classes, the informal talk with professors and the application of pre and post questionnaires to the students. Here we are presenting a preliminary set of results, since the research process is following, and new results will be appearing shortly. The results concerning videoconferencing are related to the observation of the two Master's Programs offered by PPGEP, where the results for Internet are only for one of them (the Master's program with Petrobras).

The development of the distance education courses of PPGEP.

The use of videoconferencing:

During the first stage of their distance education courses, the PPGEP chose to use videoconferencing as the main medium to delivery the content of the curriculum. Some positive reasons can be cited to explain why to use interactive technologies to deliver distance courses:

1. Videoconferencing allows to make little changes in traditional face-to-face instructional methods;
2. It is possible to use several mediums to complement communication between teacher and students (e-mail, WWW, fax, telephone, mail, personal meetings, etc.)
3. In videoconferencing courses it is possible to use several instructional activities and didactic materials such as audio, video, WEB, graphic software, showing 3D objects, etc.
4. To design material to be used in video classes is less expensive and less sophisticated than to produce other tele-learning productions such as ITV broadcasting classes, specially recording video-classes, CBT, CDROMS, which involve technical television equipment and specialized personal support, expensive TV production, time for transmission, etc.
5. Videoconferencing allows a place to socialize learning and collaborative group work.
6. It is possible to choose to use in courses more interactive (small classes) or less interactive (big classes).

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7. It can be delivered directly to private/public organizations, institutions, universities, etc.
8. It has several ways to deliver (telephone lines, satellite, ISDN, cable, fiber optics, microwaves, etc.).

However, it is not possible to ignore the other side. Videoconferencing also presents some negative aspects, which may be seen as disadvantages, and problematic in getting it fully implemented. Some of these are:

1. Problems related to the newness of this technology, like low sound and video quality, difficulty to adapt the videoconferencing room to a didactic situation, use not adequate because of the absence of experience of the technical support team.
2. The high costs of implementation, installation and maintenance of the equipment, compared to its utilization.
3. High transmission costs, and instability of the transmission infrastructure.
4. Misunderstanding of its didactic potential, reducing its usage to lecture situation , with low interaction and no knowledge exchange among participants. This problem is a consequence of a lack of training for teachers and students involved in videoconferencing courses.

Videoconferencing: what we are doing here?

Several challenges were presented to PPGEP's faculty team when they planned the pioneer Master Program at Distance offered to Equitel. The courses began in September 1996, with 36 students selected by the company managers. With no technical and pedagogical experience to teach using videoconferencing, the option was to create courses as close as possible with the traditional classes. Some technical training was given to the teachers before the classes started. A manual was written to help teachers to understand the basic issues about the new medium and what they have to know to create their courses.

Despite the fact that the teachers involved in the program were not really prepared to teach using videoconferencing, they used their vast experience in the traditional classroom and soon discovered how to avoid the most common pitfalls (like the lack of attention paid by the students to a totally oral presentation) and their creativity to improve their classes. They used their "practical theory" (Marland, 1997) to respond to the challenge posed by the new media. The faculty involved with the Master's program to Petrobras used this same strategy.

Looking at the students evaluations, we perceived that the teachers involved in both programs kept their particular teaching characteristics but tried to adapt and make their lectures more flexible, and in harmony with the new model. The students perceived and enjoyed this "opening up" of the classes. They felt that they could participate and communicate with their teachers, and that their participation was seen as important to the interactivity of the lectures. But, despite the fact that they enjoyed this change, the students also respected the knowledge accumulated by some of their most experienced teachers, and during these teachers lessons they opted for just listening and absorbing the information transmitted, which was considered as very motivating. (Cruz e Moraes, 1997)

Despite their positive opinion about the course and teachers, some students complained of what they called "distance of the content to their work objectives". This happened because, as adults and employed workers, they expected to get direct answers to their practical working problems, not "scientific abstractions". In the literature we can find this "memo style or Professional Learner". According to Nipper, professional learners are "subject triggered, short and to the point, neutral, passive and formatted ... They also must be highly sensitive to time and cost factors if engaging in professional learning at the workplace". (apud Collis, 1996, p. 156) Since some teachers ignored this expectation, some courses were not seen by the students as "adequate". For this reason, some students were very critical about the courses, but with no direct reference to it to their teachers.

The results obtained until now point to a clear necessity of a period of preparation for the educational institution that wants to adopt this new pedagogical proposal – Tele-learning. The experience of PPGEP was successful, but without adequate training to teachers, students, and technicians involved, the risk of failure is high.

Internet's use in the Technological Master's Program in Logistics / Petrobras – A pioneer initiative in its maturating phase

Beginning in August 1997, the Technological Master's Program in Logistics offered to managers and technicians of Petrobras was faced with the challenge of being the pioneer program of PPGEP using Internet. Its success is seen as fundamental in order to improve the investments of the program in this area. It was a common understanding that all students should have the necessary familiarity with Internet and the WWW to understand the proposed services, and use it without problems or a more close support. This ideal scenario was not what we got. Despite the fact that most of the students had previous contact with Internet, they used it only for fun. The majority only had access to electronic mail services, and had never even downloaded a file from the Web. They were not very well trained users, and needed more help than we had planned to offer. This was our first problem.

In order to overcome these difficulties in using the WWW course's site, we established a rich emailed dialogue with the students, trying to help them to understand how and

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why use the services offered in the Program site. Students had access to a special email address, which distributed the received messages to a supporting group formed by a technician (the webmaster), a pedagogue, and two researchers, who answered all received messages, helping students to familiarize themselves with the media (Internet), and to make a better use of the services offered.

The services offered to the students in the program WWW site are a news service - Novidades - which may be seen as a kind of electronic "notice board" where students can find all information related to the course timetable, alternative program, changed schedules, etc. It may also be used to place information about interesting events in the course related subject area. A virtual library (Biblioteca Virtual), where syllabuses, papers, assignments, etc., are sent by the teachers to students retrieval or consultation.

Another important tool is the so-called "Sala de Trabalhos", where students can leave their completed assignments, slides for computer presentations, etc., and the teachers can access and evaluate this material. Other tools developed are a discussion list, called "Sala de Discussão", one service of chat (Sala de Reunião), and a library of cases (Banco de Cases), which main goal was to be used by students and teachers in order to enrich the classroom discussions. The other tools are an email service (Mailbox), and a calendar. (Cruz e Moraes, 1997)

The main goal of the site WWW is to enlarge the possibilities of interaction among the students, between the students and teachers and between the students, the technology and the content, in every moment of the teaching/leaning process. For this reason, the objective of the WWW site is much larger than simply to duplicate the characteristics of the traditional school, but to use the potential of the Internet to accomplish in a wider way these interactions.

Technical problems appeared – the security setup of the company's network, the velocity of access[1], and the difficulty in keeping the site updated. In order to overcome these difficulties, some palliative solutions were the adoption of an external Internet's provider, the adoption of other media not considered before, such as fax machines and telephone (to send and receive documents and to promote students' discussion with the faculty team).

These problems were clearly seen as a factor that reduced the motivation of the students in using the site. In a questionnaire applied at the end of the program's first trimester, the results indicated that most students found the accessibility and navigation in the site difficult or very difficult (around 80%). However, they also emphasized that the problem of the velocity of the network was seen as the most difficult to overcome (around 80%). However, despite the problems, the students found the WWW site very useful, especially to download copies of the teacher's PowerPoint presentations and to know the latest changes in the course calendar.

[1] This problem is caused by the configuration of the Brazilian Internet's access. As a result of a politic indefinition, we have two different networks: a scientific (RNP) and a commercial (Embratel) working in parallel, and with a permanent jam in the node where two are connected.

What is happening now?

Some of the services were taken off the site, because they did not attend to the students expectations (revealed in informal conversations via VC or telephone), and also because the implied a lot more investment in technical time to be fully developed as well as maintained. Services such as the "Banco de Cases", that was seen a very powerful tool to improve the interaction and to make the discussions during class time more rich, did not attract the students. This service is now being reformulated and may even be deactivated, since it was under used during the first two trimesters of the course.

Services such as the virtual library, that is widely adopted by most of the students, and that was managed only by the technical support are fully automatic today, and the students can do their own publications. The same is going to be true to other services soon. The idea is to offer a set of services that can be easily used by the students, and easily managed by the support team. Also, a special training is offered to all teachers involved in the programs using Internet. Understanding its purpose, and knowing how to use it in its full potential, teaches, we believe, will be our best vendors of this model.

Conclusion:

The experience of PPGEP with tele-learning shows how important the adoption of new technologies is to the development of the scientific and technical production in Brazil. It also shows that there are many obstacles to overcome for its diffusion to a larger community of users. Some are problems related to the infrastructure (quality of transmission lines/medium, etc.), other are political (the absence of national resources), and the training of the people involved. Tele-learning is a vast and fertile field of research, and this paper describes only the first experiences of PPGEP in this area.

In order to conclude, it is important to say that the courses being conduced, as the two approached in this article, have an experimental character. They are aimed at the development of an adequate methodology and mechanisms to the utilization of the full potential of the technologies we have at our hand, in order to increase the number of students attended in our universities and the quality of the knowledge produced.

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